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## HEALTH PSYCHOLOGY | RESEARCH ARTICLE

# The relationship between perseverative cognitions and mental health and physical health complaints among college students

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**Abstract:** College students often experience health problems, but approaches are needed to determine those that are most vulnerable. This study examined whether perseverative cognitions (PCs) represent a common risk factor for poor health. Students ( $n = 489$ ) completed measures of PCs, posttraumatic stress disorder (PTSD) symptomatology, general mental health, and physical health complaints. Regressions indicated that PCs were associated with higher levels of PTSD symptomatology, poor mental health, and physical health complaints. Structural equation modeling analyses suggested that PTSD symptoms explain, in part, the association between PCs and physical health complaints. Results are discussed in terms of PCs as a risk stratifying factor.

**Subjects:** Psychological Science; Health Psychology; Behavioral Medicine; Posttraumatic Stress Disorder in Adults; Stress in Adults

**Keywords:** perseverative cognitions; post-traumatic stress disorder; mental health; physical health complaints; college health

Although many factors may contribute to mental and physical health issues, identifying common risk factors (particularly those that are malleable) is important as it suggests the potential to efficiently use interventions to promote health and resilience. This risk stratification approach may be especially relevant for college students for two reasons. First, with access to mental healthcare and other resources being limited for many college students (Gallagher, 2008; Hunt & Eisenberg, 2010),

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Dr. Matthew Zawadzki's (<http://faculty.ucmerced.edu/mzawadzki>) research examines how stress contributes to the development and progression of chronic disease, with a focus on cardiovascular disease and its psychosocial predictors. Among potential mechanisms linking stress to health, I examine the interactive effects of thoughts and emotions focusing largely on the role that perseverative cognitions, such as rumination and worry, have in creating, exacerbating, and extending physiological, psychological, and emotional responses to stressful experiences. The results from the present study continue to suggest the need to study how people mentally represent stress in their minds as these negative thought patterns relate to poor mental and physical health.

### PUBLIC INTEREST STATEMENT

With resources to treat mental health being scarce, especially on college campuses, identifying who might be most vulnerable to poor health is critical for successful intervention. The present study measured the health and well-being of college students through a series of surveys. It found that those who were likely to engage in repetitive negative thinking like rumination and worry were also those most likely to report both mental and physical health complaints. These results suggest that detecting who engages in these forms of negative thinking may be a way to understand who is most at risk and might benefit most from intervention approaches.

identifying contexts or situations in which an intervention could have broad-scale effects may be necessary to promote positive health. Second, college has been identified as a period of risk for increased mental and physical health issues, including depression (Furr, Westefeld, McConnell, & Jenkins, 2001), anxiety disorders (Kushner & Sher, 1993), and symptoms of posttraumatic stress disorder (PTSD; Bernat, Ronfeldt, Calhoun, & Arias, 1998). For example, a population-based study found that more than half of college students reported depression since the beginning of college; of those, approximately 9% had considered committing suicide (Furr et al., 2001). High prevalence rates for poor physical health have similarly been reported among university and college students (Lund, Reider, Whiting, & Prichard, 2010); in turn, those with poor physical health are more likely to engage in risky health behaviors (Petry & Weinstock, 2007), implicating both immediate and downstream negative health consequences. This paper extends prior work to examine whether engagement in perseverative cognitions (PCs) is a common risk factor for poor mental health and physical health complaints in college students.

PCs are cognitive representations of stress that are repeatedly activated, typically negative, and unconstructive (Brosschot, Gerin, & Thayer, 2006; Smyth, Zawadzki, & Gerin, 2013). In other words, PCs represent a pattern of thought that repetitively focuses on the same content such that it does not aid in meaning making or understanding and blocks mental capacity for those other thoughts (e.g., problem solving or reflection). They are conceptually similar to other constructs such as rumination (Nolen-Hoeksema, Morrow, & Friedrickson, 1993), worry (Borkovec, Robinson, Pruzinsky, & DePree, 1983), unconstructive repetitive thoughts (Watkins, 2008), as well as intrusive thoughts and cognitions (Rachman, 1981). Among college students, an example of PCs might include repeatedly thinking about one's potential performance on an upcoming exam and the potential for failure without reflecting on ways to improve and prepare. These negative and repetitive thoughts can result in worse cognitive and emotional states, including more depressed mood and pessimism (Lyubomirsky & Nolen-Hoeksema, 1995), angrier mood (Rusting & Nolen-Hoeksema, 1998), more anxiety and difficulty concentrating (McLaughlin, Borkovec, & Sibrava, 2007), and less effective problem solving (Lyubomirsky & Nolen-Hoeksema, 1995). In turn, these dysphoric emotional and cognitive states may predispose individuals to various poor mental and physical health outcomes (Rawson, Bloomer, & Kendall, 1994).

The first aim of this study was to examine whether those who engage in more PCs also report a range of poor health outcomes. Prior work has begun to link PCs to a variety of poor health outcomes, including depressed mood and clinical depression (Hong, 2007; Thomsen, Mehlsen, Christensen, & Zachariae, 2003), poor sleep quality (Thomsen et al., 2003; Zawadzki, Graham, & Gerin, 2013), reduced quality of life (Dupont, Bower, Stanton, & Ganz, 2014), worse self-reported physical health (Petrie et al., 2001; Thomsen et al., 2003), and worse cardiovascular function (Hogan & Linden, 2004). These individual studies are consistent with recent meta-analyses demonstrating the negative effects of PCs across a range of somatic health complaints (e.g., higher heart rate, blood pressure, and cortisol levels; Ottaviani, Thayer, Verkuil, Longiro, Medea, Couyoumdijiam, & Brosschot, 2015).

Yet, much of this work has focused on a limited range of health outcomes in any particularly sample, such as concentrating on a single measure of mental health (see exceptions: Segerstrom, Roach, Evans, Schipper, & Darville, 2010; Thomsen et al., 2003). The current study extends this work by examining both mental and physical health indicators within the same sample to determine if there is a potential generalized effect of PCs (i.e., PCs are a common risk factor). Also, most prior studies did not examine health outcomes particularly relevant to college students. College is rated as a period of high stress (Abouserie, 1994), with unique developmental challenges as students encounter new experiences and develop their own identity (Cooper, Healy, & Simpson, 1994; Hu & Kuh, 2003). We focused on posttraumatic stress disorder (PTSD) symptoms (Boals & Hathaway, 2010; Frazier et al., 2009), general self-reported mental health (Eisenberg, Hunt, Speer, & Zivin, 2011), and general reported physical health complaints (El Ansari, Oskrochi, & Stock, 2013), which are highly prevalent among college students and are each predictive of worse future health

and mortality (Chida & Steptoe, 2008; Xu & Roberts, 2010). For example, rating one's health as fair or poor predicts later life mortality (Idler & Benyamini, 1997), and almost 8% of college students rate their health in this way (Zullig, Reger-Nash, & Valois, 2012).

On a more exploratory basis, the second aim of the study was to test whether PTSD symptoms in part explain the associations between PCs and mental and physical health. Although past theory and research provides support for the model we test, we approach these analyses as exploratory given that we have cross-sectional data that cannot directly speak to causal processes. For example, in a prospective longitudinal study of road traffic accident survivors who were children, those who engaged in rumination more (among other factors) were those more likely to have and maintain PTSD symptoms three and six months after the accident (Ehlers, Mayou, & Bryant, 2003). A similar set of findings were found for adults (Ehring, Frank, & Ehlers, 2008), and has generalized to other populations (e.g., assault survivors: Kleim, Ehlers, & Glucksman, 2007; survivors of 9/11: DeRoma et al., 2003). In turn, PTSD is related to worse mental (Miller, Wolf, Martin, Kaloupek, & Keane, 2008; Zatzick et al., 2014) and physical health (Norris, Slone, Baker, & Murphy, 2006; Zoellner, Goodwin, & Foa, 2000). In other words, those who have a tendency to engage in PCs may have a cognitive vulnerability to the development of PTSD (Elwood, Hahn, Olatunji, & Williams, 2009), and then it is these PTSD symptoms that lead to worse mental and physical health. Yet, to our knowledge, the potential for PTSD to account for the effects of PCs on mental and physical health has not been explored in college students.

The present study examines the associations between PCs and mental health and physical health complaints, and explores whether PTSD accounts in part for the association between PCs and health in college students. Importantly, we measured PCs using multiple scales that more reliably assesses this construct. Most past work has often relied on single indicators of PCs that may be more limited in capturing the construct and result in idiosyncratic associations. For example, the Ruminative Response Scale is often used to test rumination (Nolen-Hoeksema & Morrow, 1991), yet this scale has considerable overlap with measures of depression (Treyner, Gonzalez, & Nolen-Hoeksema, 2003). Likewise, the Penn State Worry Questionnaire is used to assess worry (Meyer, Miller, Metzger, & Borkovec, 1990), yet this scale may particularly capture anxiety (Brown, Antony, & Barlow, 1992; Davey, 1993). Thus, using multiple scales and more broadly capturing the construct of PC allows for a comprehensive and reliable assessment of PCs and testing of its relation to mental and physical health. As such, we predict that those who report greater PCs will also report worse levels of mental health and physical health complaints compared to those reporting lesser PCs (Hypothesis 1). Furthermore, we predict that PTSD will explain, in part, the association between PCs and mental and physical health (Hypothesis 2).

## 1. Method

### 1.1. Participants

In exchange for partial course credit, 491 students participated in the study from an undergraduate psychology subject pool. Two participants were removed for having significant amounts of missing data. The resulting sample was comprised of 371 women (75.9%) and 118 men (24.1%) aged 18–62 ( $M = 20.94$ ,  $SD = 4.54$ ). Participants identified primarily as Caucasian (53.8%), followed by African American (15.3%), Hispanic (11.5%), Asian (9.6%), Native American (0.6%), and other (9.0%); one participant did not report race or ethnicity. This sample's demographics were largely consistent with the body of students from which it was drawn.

### 1.2. Materials

#### 1.2.1. Perseverative cognition scales

Based on theory and preliminary work (Smyth & Sliwinski, 2010), two scales were used to capture PCs. First, participants completed the worry and punishment subscales of the Thought Control Questionnaire (TCQ; Wells & Davies, 1994). Each subscale has six items that assess the extent to

which participants have intrusive thoughts (worry subscale; e.g., “I think more about the minor problems I have.”) or punish oneself for having the thought (punishment subscale; e.g., “I get angry at myself for having the thought.”). Due to a programming error, one item from the worry subscale was omitted (“I worry about more minor things instead.”). Participants responded using a 1 (*never*) to 4 (*almost always*) scale. All items were averaged together such that higher numbers indicated greater PCs (Cronbach’s  $\alpha = .86$ ).

Second, participants also completed the 15-item White Bear Suppression Inventory (WBSI; Wegner & Zanakos, 1994). The WBSI measures inclinations to suppress intrusive thoughts (e.g., “I always try to put problems out of my mind.”). Participants rated items using a 1 (*strongly disagree*) to 5 (*strongly agree*) scale. All items were averaged together such that higher numbers indicated greater PCs (Cronbach’s  $\alpha = .93$ ).

### 1.2.2. Mental and physical health scales

Participants responded to three scales measuring mental and physical health. We began with a measure of PTSD symptoms. Participants were asked to “...nominate a negative event from your life that is currently most distressing to you” and then completed the PTSD Checklist (PCL; Weathers, Huska, & Keane, 1991) in reference to this event. The PCL is a 17-item questionnaire designed to measure the existence of PTSD symptoms according to the diagnostic criteria for PTSD found in the DSM-IV. Participants responded to the specific version of the PCL, in which they indicated how much in the past seven days they have been bothered by particular symptoms associated with the event they nominated (e.g., “Having difficulty concentrating?”). Participants responded using a 1 (*not at all*) to 5 (*extremely*) scale. Items were summed together to create an overall score such that higher numbers indicated greater PTSD symptomatology (Cronbach’s  $\alpha = .91$ ). Scores of 50 or higher are considered indicative of PTSD (Terhakopian, Sinaii, Engel, Schnurr, & Hoge, 2008).

The General Health Questionnaire (GHQ-12; Goldberg & Blackwell, 1970) is a self-report measure designed to screen for psychiatric disorders such as depression. Using a 1 (*not at all*) to 4 (*much more than usual*) scale, participants indicated how much they experienced poor health (e.g., “Have you felt constantly under strain?”). Items were averaged together such that higher numbers indicated worse mental health (Cronbach’s  $\alpha = .88$ ).

The 54-item Pennebaker Inventory of Limbic Languidness (PILL; Pennebaker, 1982) was used to assess the experience of common health symptoms and bodily sensations. Participants indicated how often they have experienced symptoms like insomnia or dizziness using a 1 (*have never or almost never experienced*) to 5 (*more than once every week*) scale. Items were averaged together such that higher numbers indicated greater physical health complaints (Cronbach’s  $\alpha = .95$ ).

### 1.3. Procedure

All materials and procedures were approved by the relevant institutional review board. Participants completed all measures online, which served as a screener for a larger study. After completing an informed consent notice, participants completed all measures in the following fixed order: PCL, PILL, GHQ-12, TCQ, and WBSI.

### 1.4. Analytic plan

We first explored bivariate correlations between the PCs measures and PTSD symptomatology, mental health, and physical health complaints. We then explored whether there were gender and age differences in PCs, mental health, and physical health complaints. Next, to test Hypothesis 1, we conducted multivariate regression analyses in which the health outcomes (tested in separate models) were regressed on PCs, gender, and age. Due to potential conceptual overlap between the items that make up our measure of PCs and the items of our measure of PTSD symptoms (both measures contain items about intrusive thoughts and avoidance), we examined the correlations between PCs and each of the three subscales of the PCL (intrusive thoughts, avoidance, and arousal). If the correlation sizes are stronger for intrusive thoughts and avoidance than for arousal,

this pattern of results would suggest any significant correlations may be due in part to conceptual overlap between our predictor and outcome variables. However, if the correlation sizes do not significantly differ, this pattern of results would suggest limited overlap. To test Hypothesis 2, we conducted a structural equation model in AMOS 24.0 in which a latent variable of PCs—indicated by the TCQ and WBSI—predicted PTSD symptomatology, and both PCs and PTSD symptomatology predicted mental health and physical health complaints. We then tested for indirect effects of PCs on mental health and physical health complaints via PTSD symptomatology by employing a bootstrapping procedure (Cheung & Lau, 2008). We specified 5000 resamples and 95% bias corrected confidence intervals, which has the resulting effect of producing a range of indirect effects from each resampled subset of the data so as to test the stability of the parameter estimate (MacKinnon, Lockwood, & Williams, 2004). A confidence interval that does not include 0 is significant. To determine if the structural equation model was a good fit, we used standard recommendations (Hu & Bentler, 1999): a non-significant chi-square ( $\chi^2$ ), a comparative fit index (CFI) and normed fit index (NFI) greater than .95, and a root mean square error of approximation (RMSEA) less than .05 with a confidence interval from .00 to .08.

## 2. Results

### 2.1. Preliminary analyses

All variables were submitted to bivariate correlations. As can be seen in Table 1, greater engagement in PCs (the TCQ and WBSI were examined separately) was associated with greater PTSD symptomatology and poorer mental health and physical health complaints. Likewise, PTSD symptomatology was positively correlated with mental health and physical health complaints with each other.

We then tested if there were gender and age differences in PCs, mental health, and physical health complaints. For gender differences, a set of independent samples t-tests were conducted comparing men and women on all variables. Women, compared to men, reported greater PCs (TCQ:  $M = 1.76$ ,  $SD = 0.45$  vs.  $M = 1.65$ ,  $SD = 0.48$ ;  $p = .022$ ; WBSI:  $M = 3.68$ ,  $SD = 0.75$  vs.  $M = 3.29$ ,  $SD = 0.92$ ;  $p < .001$ ), PTSD symptomatology ( $M = 2.44$ ,  $SD = 0.82$  vs.  $M = 2.23$ ,  $SD = 0.77$ ;  $p = .014$ ), poorer mental health ( $M = 2.25$ ,  $SD = 0.52$  vs.  $M = 2.15$ ,  $SD = 0.52$ ;  $p = .051$ ), and greater physical health complaints ( $M = 2.24$ ,  $SD = 0.55$  vs.  $M = 1.95$ ,  $SD = 0.56$ ;  $p < .001$ ). For age differences, we correlated age with PCs, mental health, and physical health complaints. Those who were older reported fewer PCs than those younger (TCQ:  $r = -.13$ ,  $p = .005$ ; WBSI:  $r = -.10$ ,  $p = .033$ ), but no statistically significant differences emerged for mental health nor physical health complaints ( $r_s < .09$ ,  $p_s > .05$ ).

#### H1: PCs and Mental and Physical Health

To test Hypothesis 1, multivariate regressions were conducted in which PTSD symptomatology, mental health, and physical health complaints (tested in separate models) were regressed on PCs, gender, and age. Because of the medium to high correlation between the two measures of PCs ( $r = .51$ ), the TCQ and WBSI scale means were averaged together to create a single PCs index. We next examined the correlations between PCs and each of the three subscales of the PCL (intrusive thoughts, avoidance, and arousal) to assess for potential overlap in items between our predictor and outcome variables. The resulting correlations were  $r_s = .44$ ,  $.39$ , and  $.44$ , respectively. None of these correlation sizes significantly differed from each other (all  $Z_s < 1$ ). As can be seen in Table 2, those who reported greater PCs were those who reported greater PTSD symptomatology, poorer mental health, and greater physical health complaints ( $p_s < .001$ ) even after controlling for gender and age.

#### H2: Indirect Effects of PCs on Health via PTSD Symptomatology

We then examined whether part of the effect of PCs on mental health and physical health complaints could be explained by PTSD symptomatology. We conducted a structural equation

**Table 1. Bivariate correlations of perseverative cognitions, PTSD symptomatology, mental health, and physical health complaints**

	1.	2.	3.	4.	5.
1. PCs (TCQ)	–				
2. PCs (WBSI)	.51***	–			
3. PTSD symptomatology (PCL)	.45***	.42***	–		
4. Mental Health (GHQ)	.40***	.36***	.51***	–	
5. Physical Health Complaints (PILL)	.42***	.42***	.40***	.31***	–
Possible Range	1–4	1–5	17–85	1–4	1–5
M	1.74	3.58	40.63	2.23	2.17
SD	0.46	0.81	13.83	0.52	0.57

Note: \*\*\* $p < .001$ . PCs = Perseverative Cognitions; TCQ = Thought Control Questionnaire; WBSI = White Bear Suppression Inventory; PCL = PTSD Checklist; GHQ = General Health Questionnaire; PILL = Pennebaker Inventory of Limbic Languidness.

**Table 2. Multivariate regressions testing PCs, gender, and age as predictors of mental and physical health**

	PTSD Symptomatology (PCL)	Mental Health (GHQ)	Physical Health Complaints (PILL)
PCs	.48***	.43***	.46***
Gender	.02	.01	.14***
Age	-.03	-.004	.02
<i>Model Statistics</i>			
df	3, 485	3, 485	3, 485
F	50.71	36.57	53.54
p	< .001	< .001	< .001
r <sup>2</sup>	.24	.18	.25

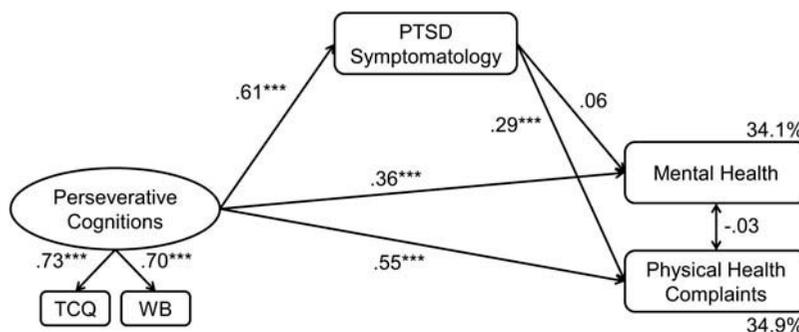
Note: \*\*\* $p < .001$ . PCs = Perseverative Cognitions (combined Thought Control Questionnaire and White Bear Suppression Inventory); PCL = PTSD Checklist; GHQ = General Health Questionnaire; PILL = Pennebaker Inventory of Limbic Languidness. Gender is a dichotomous variable (0 = Male, 1 = Female). Standardized beta coefficients are reported.

model in which a latent variable of PCs indicated by the TCQ and WBSI predicted PTSD symptomatology, and both PCs and PTSD symptomatology predicted mental health and physical health complaints. The model fit the data well:  $\chi^2(2) = 0.58, p = .748, CFI = 1.000, NFI = .999, RMSEA = .00, RMSEA\ 90\% \text{ CI} = .00 \text{ to } .06$ . As can be seen in Figure 1, and replicating the bivariate correlations, PCs predicted PTSD symptomatology, mental health, and physical health complaints ( $ps < .001$ ). In turn, PTSD symptomatology predicted physical health complaints ( $p < .001$ ) but not mental health ( $p = .315$ ). The model accounted for 34.1% of the variance in mental health and 34.9% of the variance in physical health complaints. Finally, the indirect effect for PCs on mental health via PTSD symptomatology did not include 0, thus indicating a significant effect (95% CI [.15, .40]); however the indirect effect for physical health complaints did (95% CI [-.08, .18]). In follow-up testing, results were nearly identical when controlling for participant age and sex (results available upon request).

### 3. Discussion

Past research has demonstrated that the college years represent a period of risk for poor health among students (Bernat et al., 1998; Furr et al., 2001; Kushner & Sher, 1993; Lund et al., 2010;

**Figure 1. Structural equation model testing for indirect effects of perseverative cognitions on mental health and physical health complaints via PTSD symptomatology. The percentages by mental and physical health indicate the amount of variance of these variables that is explained by the model.**



\*\*\* $p < .001$ .

Petry & Weinstock). In line with this work, students who reported more PCs—that is, unwanted repetitive, unconstructive, and negative thoughts (Brosschot et al., 2006; Smyth et al., 2013)—were those who also reported worse mental health and physical health complaints. Importantly these results suggest a general effect across outcome “types,” including one’s psychological well-being and reports of daily physiological/health functioning. Although more work is needed to test this effect more generally (e.g., using objective biological indicators of poor health), and to examine these relationships longitudinally to test whether PCs predict the onset of poor health (e.g., see Zawadzki et al., 2013), these results suggest that PCs may be a general mechanism leading to poor mental and physical health among college and university students.

In addition, we found that PTSD symptomatology explained part of the relationship between PCs and physical health complaints but not mental health. This analysis was tested with cross-sectional data that cannot directly speak to causality; however, these results are consistent with theory and research suggesting such a relationship. For example, a review suggests that the tendency to engage in rumination and have a sensitivity to experiencing anxiety—what could be considered types of PCs—makes one cognitively vulnerable to the development of PTSD (Elwood et al., 2009). Indeed, some empirical work bears this out finding that engaging in more ruminative thinking after a traumatic event prospectively predicted the onset and maintenance of PTSD months later (Ehlers et al., 2003; Ehring et al., 2008; Kleim et al., 2007). Moreover, PTSD is associated with worse mental and physical health (Miller et al., 2008; Norris et al., 2006; Zatzick et al., 2014; Zoellner et al., 2000). That said, it is not clear why the expected pattern of results was found for physical health complaints but not mental health. We note that the bivariate correlations demonstrated a significant positive relationship between PTSD symptomatology and mental health. Thus, it appears that PCs account for this relationship when included in the analysis. One possibility is that general mental health issues are highly prevalent among college students (e.g., the prevalence of depressed mood ranges from 10–25%: Mackenzie et al., 2011), and thus might appear in more students than only those who have PTSD symptomatology. Future research may benefit from continuing to explore potential differential relationships of PTSD symptomatology with mental and physical health.

Although the need to intervene is apparent, there is less consistent knowledge concerning how to intervene. It would be easy to say that all students experiencing symptoms consistent with PTSD or other psychological health problems should engage in psychotherapy, yet this is likely unrealistic. In light of research suggesting that mental health resources are often limited on campuses ranging from small colleges to large universities (Gallagher, 2008; Hunt & Eisenberg, 2010), a challenge will be in the development and implementation of readily accessible programs that are able to be administered in groups, and/or that have potential broad-scale effects. Given the findings of the present study, that those who engage in PCs may be vulnerable to a range of worse health problems, targeting those students prone to ruminating, worrying, and otherwise experiencing intrusive cognitions may be a promising start. Ideally one would want to prevent individuals from engaging in PCs, yet this might not be possible and perhaps critical. Instead, it may be most important to take the often common and natural PCs that individuals have and help

to make those unconstructive thoughts more constructive. A systematic review concluded that although unconstructive repetitive thoughts were associated with depression, anxiety, and difficulties in physical health, when those thoughts were constructive there was faster recovery from traumatic events and better engagement in adaptive planning and health-promoting behaviors (Watkins, 2008). In fact, there is an emerging range of interventions showing potential to influence PCs, including expressive writing (Sloan, Marx, Epstein, & Dobbs, 2008) and writing about life goals (Teismann, Het, Grillenberger, Willutzki, & Wolf, 2014), meditation (Jain et al., 2007), social support seeking (Nolen-Hoeksema & Davis, 1999), and cognitive behavioral therapy (Watkins et al., 2007). A common reason that all may be effective is their capacity to transform more negative unconstructive thoughts to more constructive forms.

### 3.1. Limitations

Prior research and theory guided our analyses, yet the data were cross-sectional and cannot directly speak to issues of causality. As such, alternative models may be plausible and potential third-variables could be contributing to the observed pattern of results. For example, trait neuroticism and negative affect have been found to associate with many of the variables in the tested model (e.g., Watson & Pennebaker, 1989). Thus, some of the association between PCs and mental health, for example, may have been due to trait neuroticism. Yet, work testing the associations between rumination and depressive symptoms and poor sleep quality among college students continued to find significant relationships after controlling for trait neuroticism (Zawadzki et al., 2013). Future work should explore these relationships with longitudinal data to enhance capacity for causal inferencing. In addition, the majority of participants were women, which is common for participants from an undergraduate psychology subject pool. Yet, such a sample may limit generalizability. For example, women tend to report more rumination than men (Broderick, 1998; Nolen-Hoeksema & Jackson, 2001). Controlling for participant gender in the present study, however, did not influence the results. This suggests that although levels may be different across women and men, which was also true in the present study, the general impact of PCs on health is consistent across gender (Nolen-Hoeksema & Harrell, 2002), as well as age and race (Zawadzki, Sliwinski, & Smyth, 2018). A strength of the study was the use of multiple scales to robustly measure PCs to avoid potential idiosyncratic relationships between a particular scale and outcome. It should be noted that a similar pattern of results emerged when using each individual scale (results available upon request), which is to be expected given the correlation between the two scales and the strength of loadings for the latent PCs variable. Yet, we were still reliant on self-report to measure a complex cognitive process, as well as the assessments of mental and physical health. Future work should supplement self-report with observational, clinical, and/or objective measures.

### 4. Conclusion

Many campuses' health services are faced with the challenge of identifying on whom to specifically intervene, and how, especially in light of limited resources and high level of mental health problems among college students. In addition, it is increasingly recognized that college represents a unique period of development that shapes future outcomes. Notably, the health problems that develop in college are likely to persist later in life or predict more deleterious health consequences (Chida & Steptoe, 2008; Xu & Roberts, 2010). Although much work is yet to be done on how to intervene, results of the present study suggest that those who engage in PCs are also those who have worse mental and physical health. In other words, PCs may be a risk stratifier for identifying those most in need.

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#### Competing Interests

The authors declare no competing interests.

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